SCTE | STANDARDS

Digital Video Subcommittee

SCTE STANDARD

SCTE 187-1 2019 (R2024)

Stereoscopic 3D Formatting and Coding for Cable

NOTICE

The Society of Cable Telecommunications Engineers (SCTE) Standards and Operational Practices (hereafter called "documents") are intended to serve the public interest by providing specifications, test methods and procedures that promote uniformity of product, interoperability, interchangeability, best practices, and the long term reliability of broadband communications facilities. These documents shall not in any way preclude any member or non-member of SCTE from manufacturing or selling products not conforming to such documents, nor shall the existence of such standards preclude their voluntary use by those other than SCTE members.
SCTE assumes no obligations or liability whatsoever to any party who may adopt the documents. Such adopting party assumes all risks associated with adoption of these documents and accepts full responsibility for any damage and/or claims arising from the adoption of such documents.
NOTE: The user's attention is called to the possibility that compliance with this document may require the use of an invention covered by patent rights. By publication of this document, no position is taken with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details may be obtained from the standards developer.
SCTE shall not be responsible for identifying patents for which a license may be required or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.
Patent holders who believe that they hold patents which are essential to the implementation of this document have been requested to provide information about those patents and any related licensing terms and conditions. Any such declarations made before or after publication of this document are available on the SCTE web site at https://scte.org.

All Rights Reserved
© 2024 Society of Cable Telecommunications Engineers, Inc.
140 Philips Road
Exton, PA 19341

Document Tags

☒ Specification	☐ Checklist	☐ Facility
☐ Test or Measurement	☐ Metric	☒ Access Network
☐ Architecture or Framework	☒ Cloud	☐ Customer Premises
☐ Procedure, Process or Method		

Document Release History

Release	Date
SCTE 187-1 2012	2012
SCTE 187-1 2019	*2019*
SCTE 187-1 2019 (R2024)	*April 29, 2024*

Note: Standards that are released multiple times in the same year use: a, b, c, etc. to indicate normative balloted updates and/or r1, r2, r3, etc. to indicate editorial changes to a released document after the year.

This document is identical to SCTE 187-1 2019 except for informative components which may have been updated such as the title page, NOTICE text, headers and footers. No normative changes have been made to this document.

 © 2024 SCTE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 SCOPE

This document is identical to SCTE 187-1 2019 except for informative components which may have been updated such as the title page, NOTICE text, headers and footers. No normative changes have been made to this document.

This document defines the video-related formatting, and encoding parameters for high-definition frame-compatible stereoscopic 3D content for distribution on cable television systems. Encoding parameters and constraints defined by this specification can be applied to different content types, including broadcast programming, switched digital video (SDV), VOD content, and advertising content to be inserted into broadcast or VOD content.

This document defines only the specific parameters relevant to high-definition frame-compatible S3D content beyond what are already required and specified elsewhere for flat (2D) video content and signaling. Frame-compatible S3D programming will otherwise follow all standardized encoding and signaling practices except where specifically identified in this document. This document does not define a complete distribution method nor does it define all aspects of the cable system infrastructure that content encounters during distribution and playback.

2.0 NORMATIVE REFERENCES

The following documents contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of subcommittee approval, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

2.1 SCTE References

[SCTE 43]	ANSI/SCTE 43 2005, Digital Video Systems Characteristics Standard for Cable Television
[SCTE 54]	ANSI/SCTE 54 2009, Digital Video Service Multiplex and Transport System Standard for Cable Television
[SCTE 128-1]	ANSI/SCTE 128-1 2018, AVC Video Constraints for Cable Television Part 1: Coding
[SCTE 187-2]	SCTE 187-2 201x Stereoscopic 3D Transport & Signaling
[SCTE 215-1]	ANSI/SCTE 215-1 2018, HEVC Video Constraints for Cable Television Part 1: Coding
[SCTE 215-2]	ANSI/SCTE 215-2 2018, HEVC Video Constraints for Cable Television Part 2: Transport

2.2 Standards from other Organizations

[IEC 13818-1]	ISO/IEC 13818-1:2018, International Standard, Information Technology - Generic Coding of Moving Pictures and Associated Audio Information: Systems
[IEC 13818-2]	ISO/IEC 13818-2:2013 (E), International Standard, Information Technology - Generic Coding of Moving Pictures and Associated Audio Information: Video
[ITU H.264]	ITU-T. Recommendation H.264 (06/2019) Advanced video coding for generic audio visual services
[ITU H.265]	ITU-T Recommendation H.265 (06/2019), High efficiency video coding
[SMPTE 274M]	SMPTE 274M-2008, Standard for Television - 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates
[SMPTE 296]	SMPTE 296-2012, Standard for Television, 1280 x 720 Progressive Image 4:2:2 and 4:4:4 Sample Structure – Analog and Digital Representation and Analog Interface
[SMPTE 2036-1]	Ultra High Definition Television- Image Parameter Values for Program Production

3.0 INFORMATIVE REFERENCES

The following documents can provide valuable information to the reader but are not required when complying with this standard.

3.1 SCTE References

[SCTE 187-3]	SCTE-187-3 201x Informative Guidance for Stereoscopic Video

4.0 COMPLIANCE NOTATION

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified shall never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

5.0 DEFINITIONS AND ACRONYMS

3DTV	Three-Dimensional Television
ASCII	American Standard Code for Information Interchange
AFD	Active Format Descriptor
AVC	Advanced Video Coding
FC-S3D	Frame-Compatible Stereoscopic Three-Dimensional
FC-S3D-ZD	FC-S3D with Zero Disparity
GOP	Group of Pictures
HD	High Definition
HEVC	High Efficiency Video Coding
MPEG	Moving Picture Experts Group
NAL	Network Abstraction Layer

PSI	Program-Specific Information
PMT	Program Map Table
S3D	Stereoscopic, three-Dimensional
SbS	Side-by-Side
SEI	Supplemental Enhancement Information
STB	Set Top Box
TaB	Top-and-Bottom
UHD	Ultra High Definition
VUI	Video Usability Information
ZPS	Zero Parallax Setting

Frame-Compatible Stereoscopic Three-Dimensional (FC-S3D): Refers to video content composed of left and right eye stereoscopic image pairs assembled into single packed video frames for delivery through legacy video distribution systems. The left and right image pair are typically subject to a filtering, decimation and formatting process to generate a packed frame that has the same pixel count as the original left or right frame. A reverse of this process is performed to reconstruct the full stereoscopic image pair prior to display. Examples of frame-compatible formats include top-bottom and side-by-side.

FC-S3D-Zero Disparity (FC-S3D-ZD): Refers to a subset of FC-S3D content in which the left and right images are identical. Standard 2D content can be pre-processed into FC-S3D-ZD to match the preceding or succeeding 3D content to facilitate seamless transitions as described in Section 8.4.

6.0 INTRODUCTION

This standard is part one of a three-part standard that describes the use of stereoscopic, three-dimensional (S3D) video programming using a frame-compatible delivery mechanism for cable systems in North America. In many ways the FC-S3D signals can be processed and handled in the same way as flat (2-dimensional) video programming, and hence it is described as frame-*compatible*. The purpose of this three-part standard is to define those parts that are necessarily different from conventional (2-dimensional) video programming.

7.0 DOCUMENT STRUCTURE

Part 1 of this standard (this document) defines the video formatting and constraints as well as specific 3D signaling that is part of the video user data bits as shown below in Figure 1. Part 2 of this standard [SCTE 187-2] defines the program-specific information (PSI)

requirements for signaling, which are carried in the program map table (PMT) and also illustrated below in Figure 1. Finally, Part 3 of this standard [SCTE 187-3] is an informative document that provides tutorial and reference information about the implications of certain formatting as it applies to stereoscopic 3D production and content preparation.

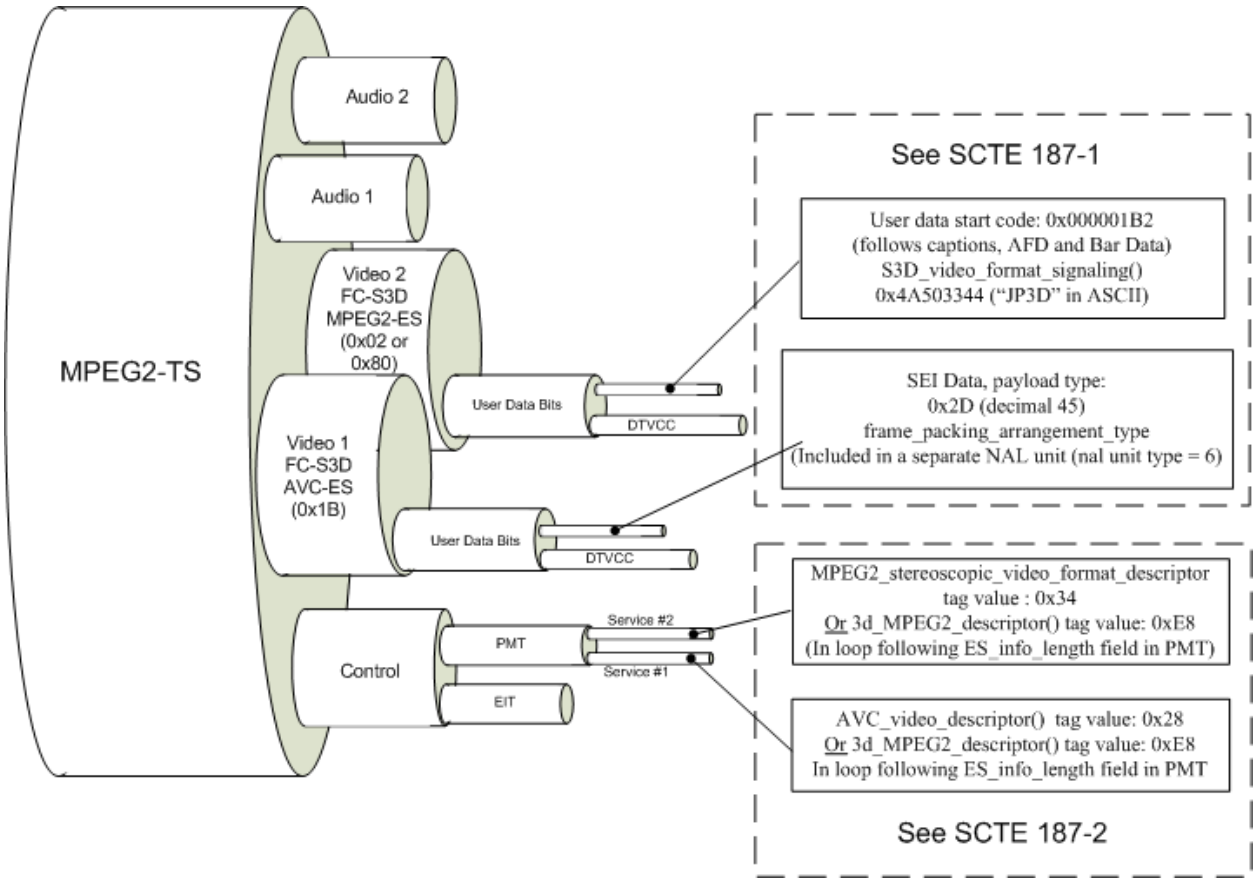


Figure 1 - Focus of Part-1 and Part-2

8.0 FRAME-COMPATIBLE STEREOSCOPIC 3D FORMATTING/CODING

This section describes the normative specifications for frame-compatible stereoscopic 3D-encoded video (FC-S3D). FC-S3D content ***shall*** meet all other applicable SCTE standards for 2-dimensional high-definition and ultra high definition video defined by [SCTE 43], [SCTE 54], [SCTE 128-1], and [SCTE 215-1] with additional requirements noted below.

8.1 Synchronization

TaB formatting ***shall*** be coded with time-synchronous left-eye and right-eye images within a single frame.

SbS formatting ***shall*** be coded with time-synchronous left-eye and right-eye images within a single frame.

8.2 Top-and-Bottom (TaB) frame-compatible format

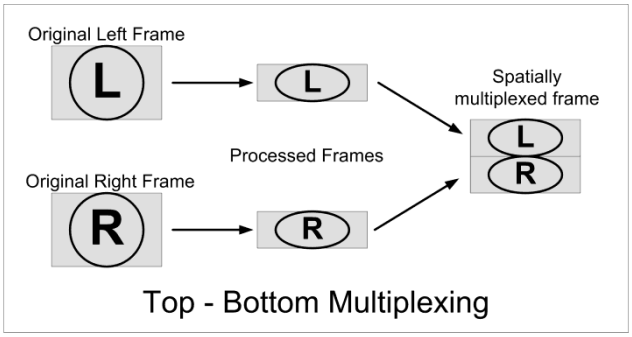


Figure 2 - TaB Multiplexing

TaB formatting ***shall*** be used with progressive (720p and 1080p) HD video and (2160p) UHD formats exclusively.

TaB formatting *may* be used with MPEG-2, withAVC/H.264, or with HEVC video coding.

TaB formatting ***shall*** be oriented with the left-eye image on the top half of the frame and right-eye image on the bottom half of the frame, without any inversion or mirroring.

For 720p TaB formats, the left-eye image ***shall*** occupy lines 26 to 385, and the right-eye image ***shall*** occupy lines 386 to 745 of the SMPTE 296M frame.

For 1080p TaB formats, the left-eye image ***shall*** occupy lines 42 to 581, and the right-eye image ***shall*** occupy lines 582 to 1121 of the SMPTE 274M frame.

For higher resolution TaB formats, the left-eye image ***shall*** occupy in the active video portion of the frame lines 1 to [Total Active Video Lines/2] and right-eye image ***shall*** occupy in the active video portion of the frame lines [(Total Active Video Lines)/2 +1] to [Total Active Video lines]. For example, a 3840x2160 picture embedded in the frame would contain the left image on lines 1 to 1080 and the right image on lines 1081 to 2160 where the lines correspond to the active video area portion of the frame.

TaB formatting ***shall*** vertically down-sample the left and right views symmetrically using any anti-aliased resizing algorithm that reduces resolution and size only in the vertical direction and combines adjacent lines. This means that a simple 2-dimensional image processed in this way will produce exactly the same reduced image for the left and right views. Note: Figure 3 below illustrates the rearrangement and down-sample processing of the TaB 3D format:

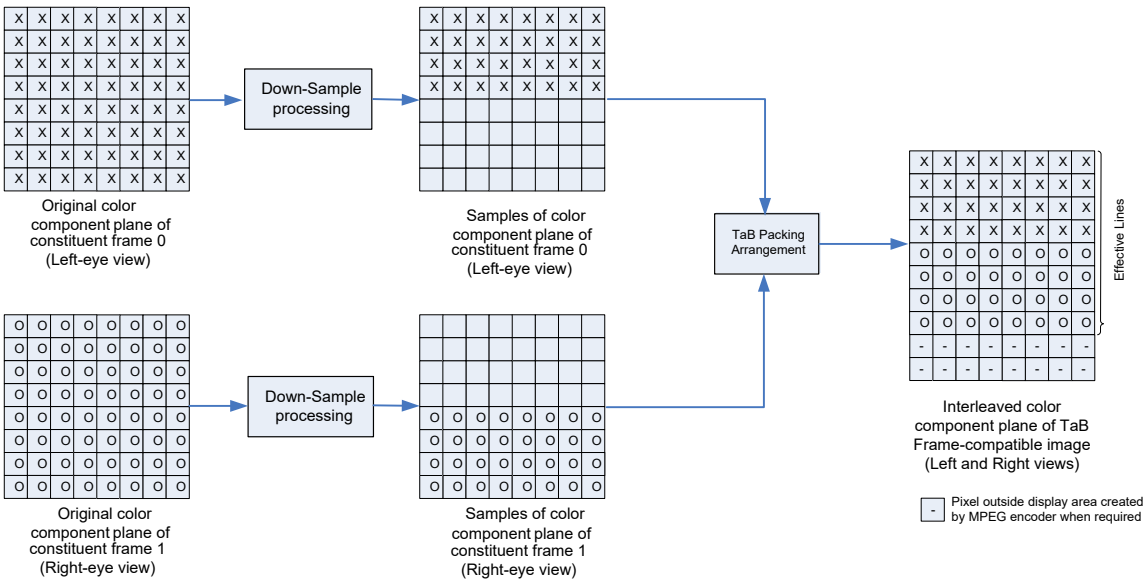


Figure 3 - Rearrangement and Down-Sample of TaB Format

TaB formatting ***shall*** comply with the details described in Figure 4 and Figure 5.

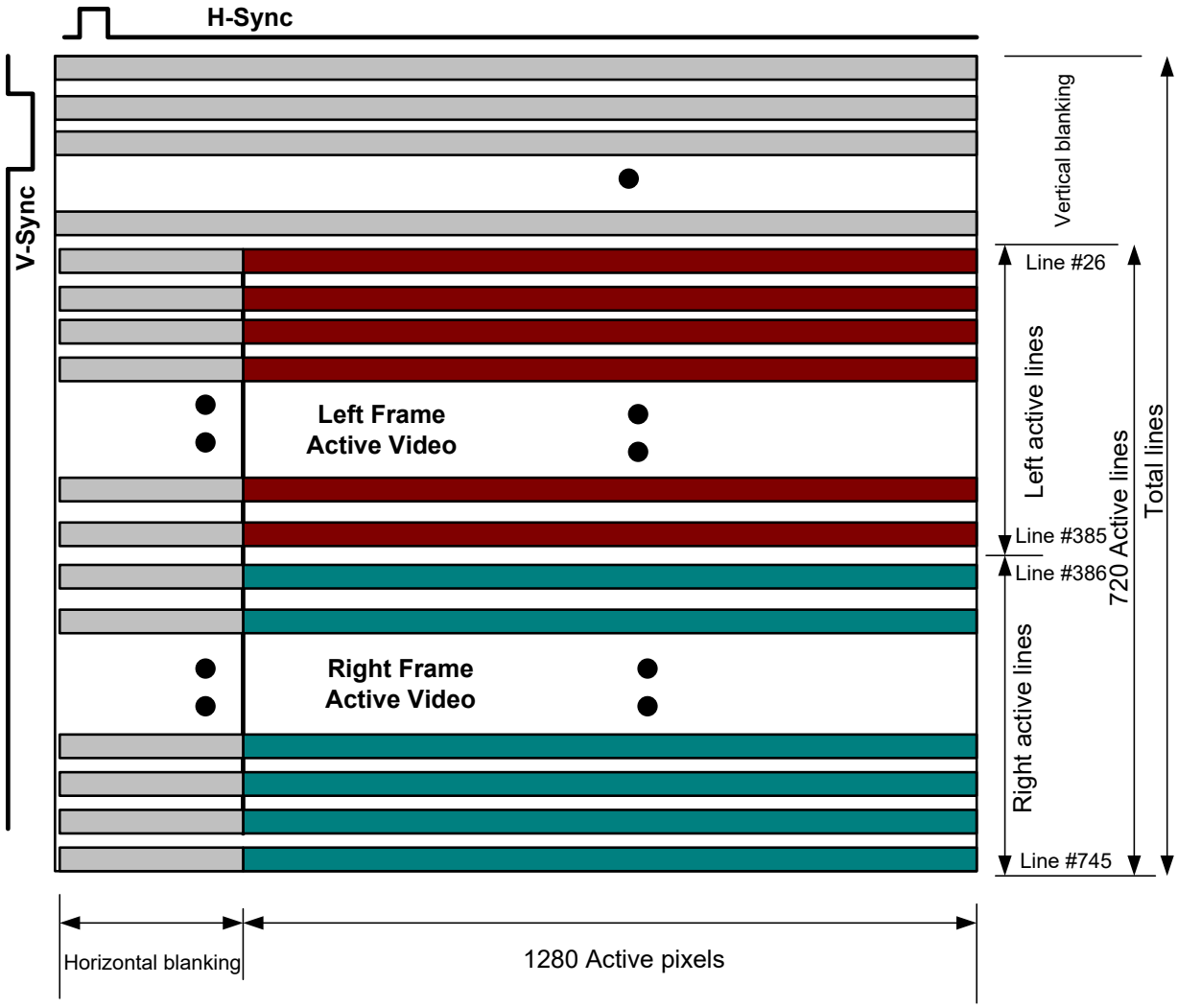


Figure 4 - TaB Source Formatting for 720p Video Format

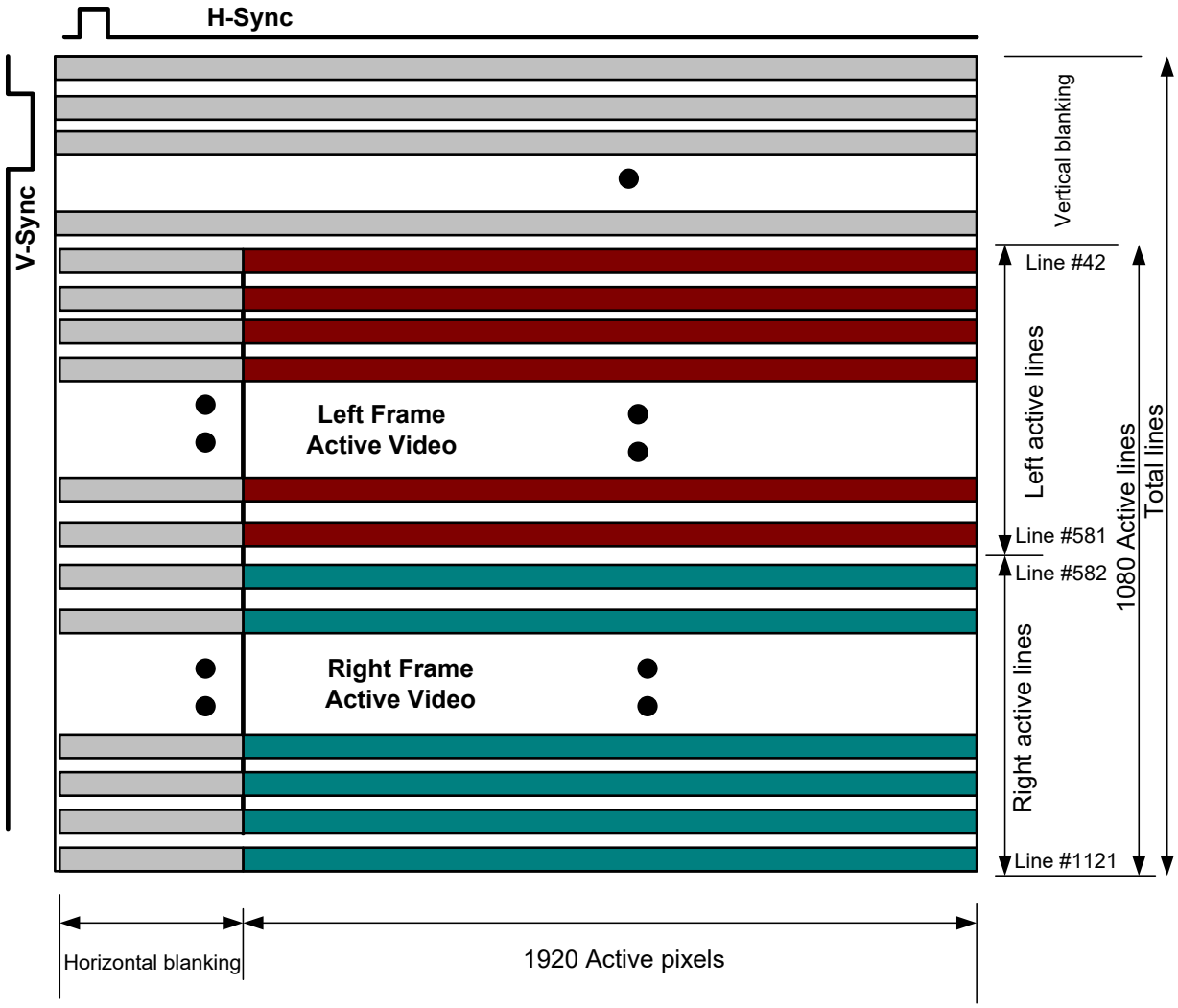


Figure 5 - TaB Source Formatting for 1080p Video Format

8.3 Side-by-Side (SbS) frame compatible format

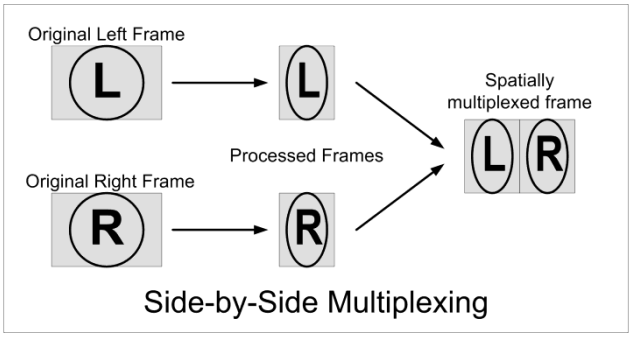


Figure 6 - SbS Multiplexing

SbS formatting ***shall*** be used with 1080 line interlaced (1080i) HD video formats exclusively.

SbS formatting *may* be used with MPEG-2,with AVC/H.264, or with HEVC/H.265 video coding.

SbS formatting ***shall*** be oriented with the left-eye image on the left half of the frame and right-eye image on the right half of the frame, without any inversion or mirroring.

For SbS formatting, the left-eye image ***shall*** occupy samples 0 to 959, and the right-eye image ***shall*** occupy samples 960 to 1919 of the SMPTE 274M frame.

8.3.1

SbS formatting ***shall*** horizontally down-sample the left and right views symmetrically using any anti-aliased resizing algorithm that reduces resolution and size only in the horizontal direction and combines adjacent pixels. This means that a simple 2-dimensional image processed in this way will produce exactly the same reduced image for the left and right views.

Figure 7 below illustrates the rearrangement and down-sample processing of the SbS 3D format used for cable systems:

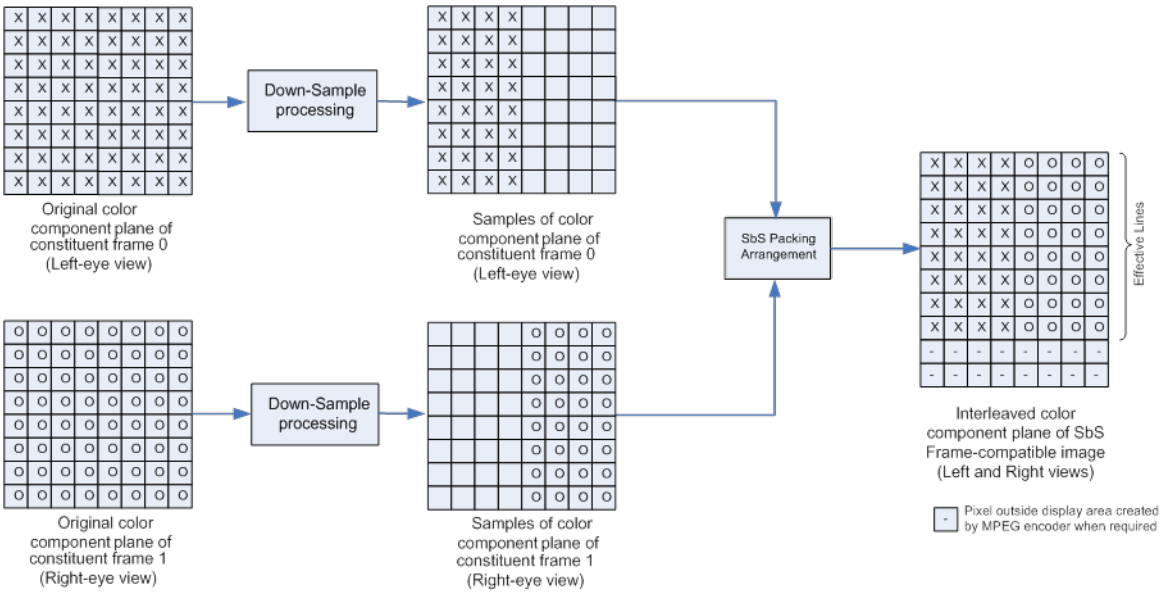


Figure 7 - Rearrangement and down-sample of SbS format

SbS formatting ***shall*** comply with the details described in Figure 8 below:

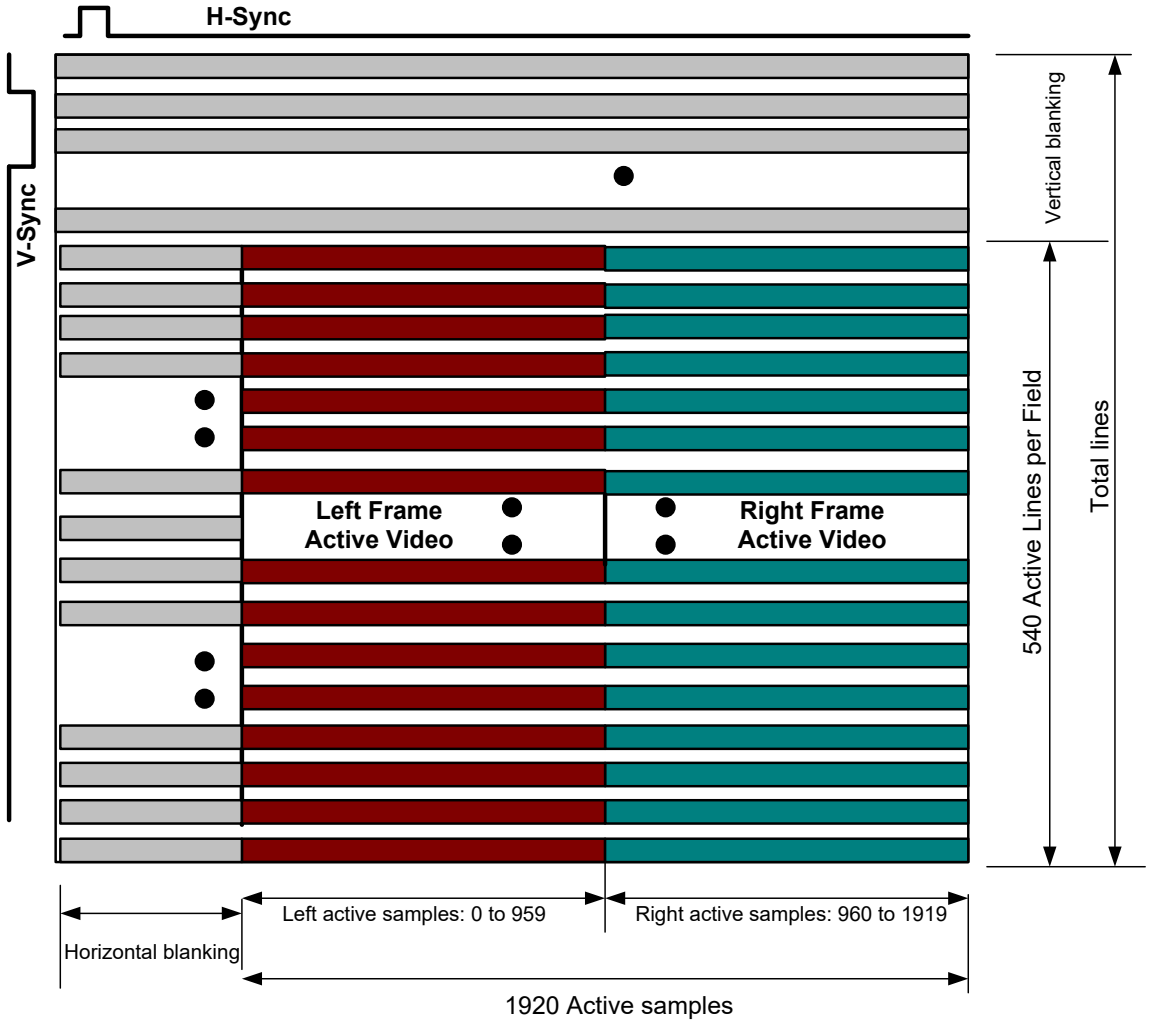


Figure 8 - SbS source formatting for 1080i video format (same for both fields)

8.4 Concatenation of FC-S3D with Full-Resolution 2D Content: INFORMATIVE

There are both permitted and preferred ways of concatenating 2D and 3D content. Any concatenated streams that present a transition between frame-compatible S3D and full-resolution 2D images might result in a disruptive viewing experience from some decoders even when all signaling is compliant.

8.4.1 Seamless Splice Points

The preferred concatenation method is to pre-format the full-resolution 2D content as FC-S3D with zero disparity (FC-S3D-ZD) such that the video, transport, and signaling parameters match the adjacent FC-S3D content. 2D content formatted in this way is fully FC-S3D compliant. It is signaled, processed, and displayed as FC-S3D of the same resolution as the preceding or following stereoscopic content but with a flat 2D visual experience. The benefit is that there are no video mode transitions at the splice points, thereby avoiding the potential for disruptions.

Figure 9 below depicts examples of this preferred seamless method:

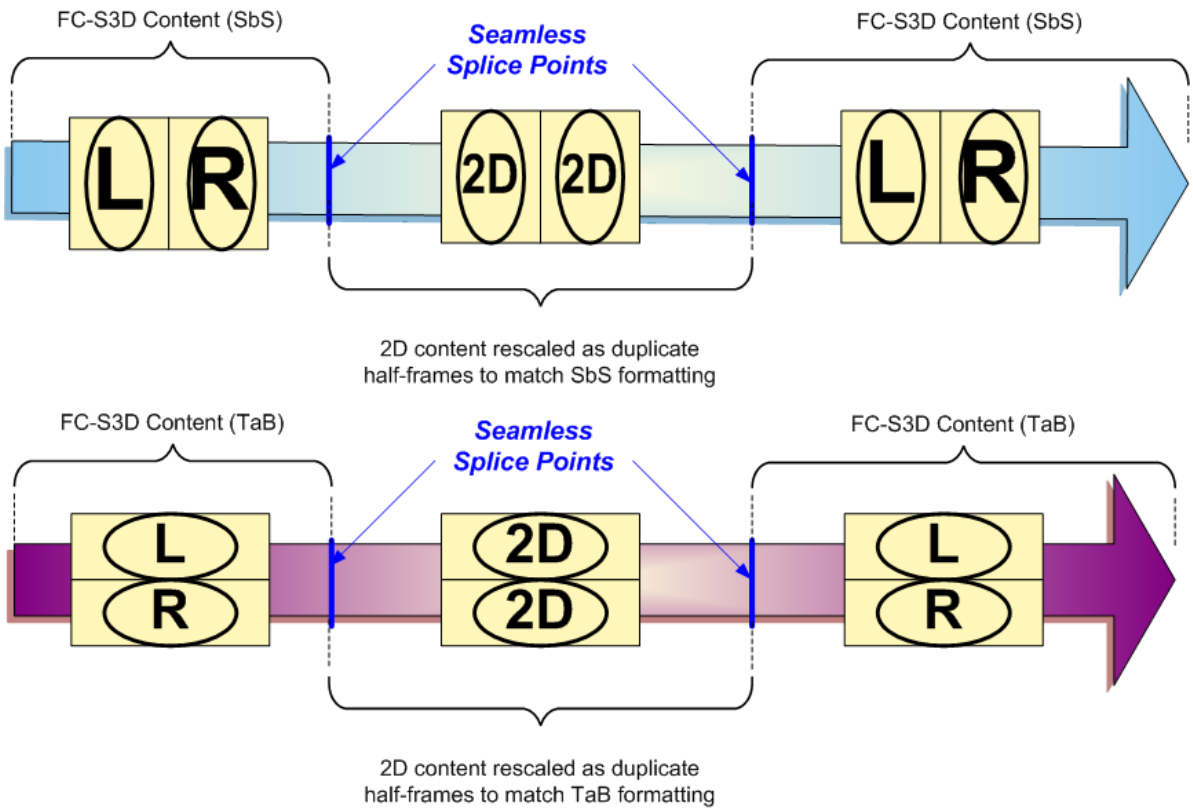


Figure 9 - Seamless Splice Points

8.4.2 Potentially Disruptive Splice Points

The permitted but not preferred method is to directly concatenate the full-resolution 2D content signaled as 2D content with FC-S3D content signaled as FC-S3D content. Video decoders will see the transitions in signaling and respond with changes in decoding and presentation mode. For some decoders the resulting video mode changes at each transition from 2D to FC-S3D and from FC-S3D to 2D can result in user perceptible decoding disruptions.

Figure 10 below depicts examples of this permitted but not preferred and potentially disruptive method of concatenation:

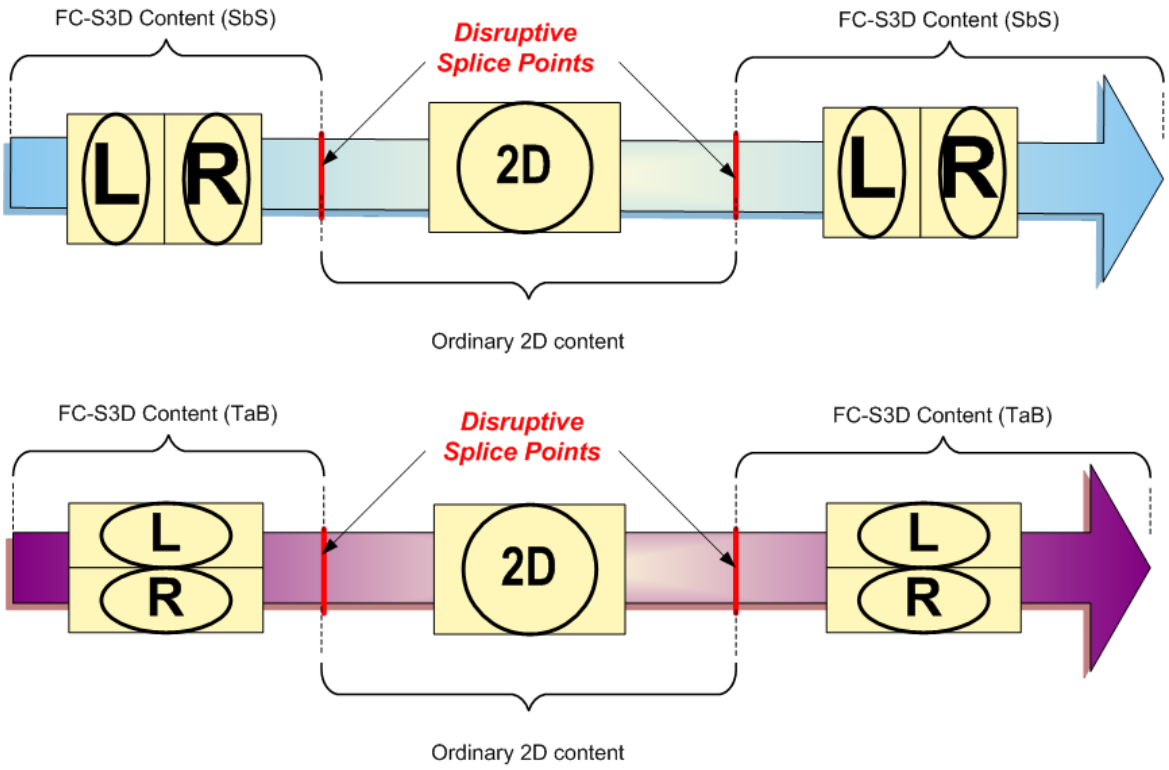


Figure 10 - Disruptive Splice Points

8.5 Letterboxing and Side-panels with 3D content

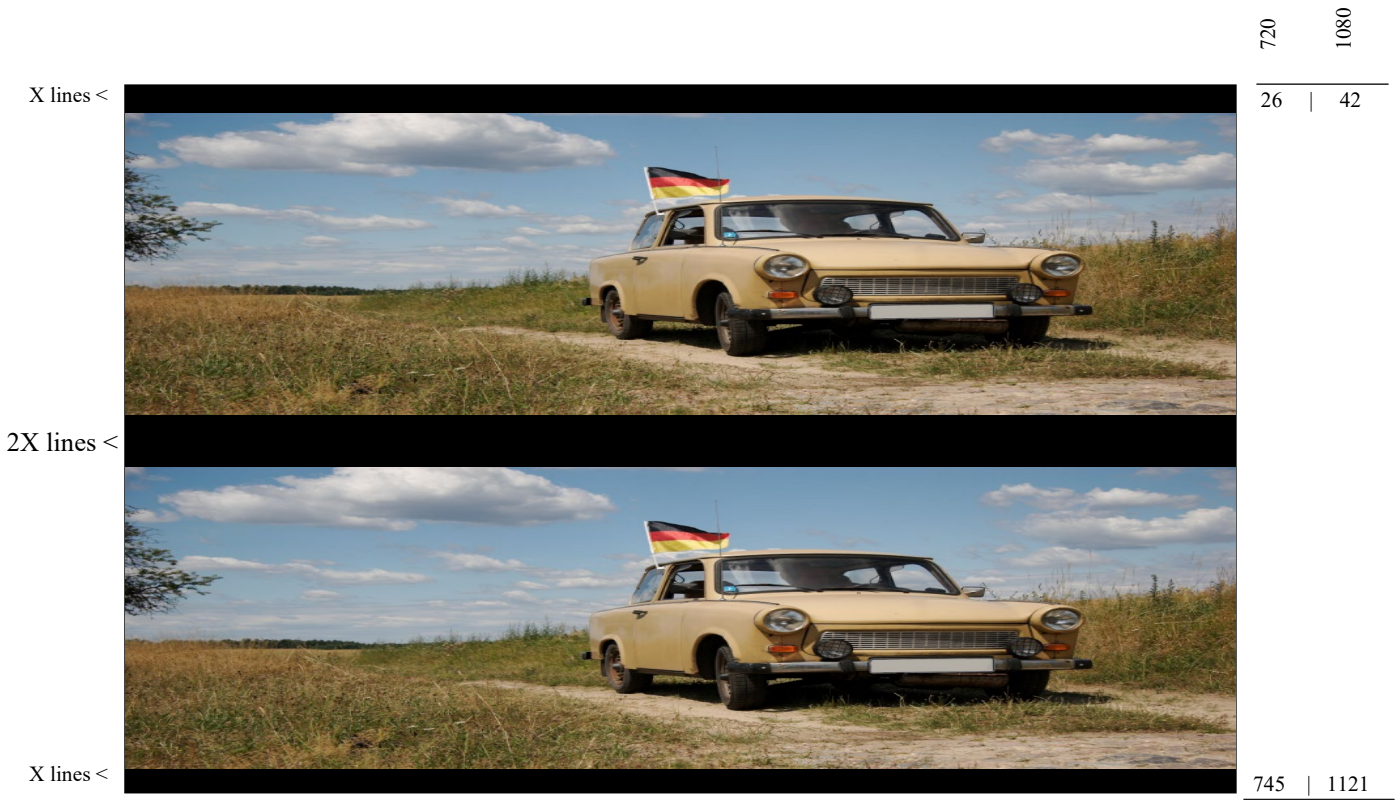
Any 1080 line S3D content formatted as TaB where the source material is letter-boxed ***shall*** be formatted such that corresponding picture elements of the left-eye image are always separated by exactly 540 lines from those corresponding picture elements of the right-eye image. For example, elements of line 62 are aligned with corresponding elements of line 602 and so on down the picture structure, so that elements of line 519 are also aligned with line 1059 as shown in Figure 11 below.

Any 720 line S3D content formatted as TaB where the source material is letterboxed ***shall*** be formatted such that corresponding picture elements of the left-eye image are always separated by 360 lines from those corresponding picture elements of the right-eye image. For example, Figure 8 below shows that picture elements of line 26 are aligned with corresponding picture elements of line 386 and so on down the picture structure, so that elements of line 385 are also aligned with line 745.

Any higher resolution line S3D content formatted as TaB where the source material is letterboxed ***shall*** be formatted such that corresponding picture elements of the left-eye image are always separated by exactly [Total lines of active video/2] from those

corresponding picture elements of the right-eye image. For example, a 3840x2160 UHD picture is separated by 1080 lines.

Any blank scan lines at the top of the TaB frame *should* be equal in number and align with corresponding blank scan lines at the bottom of the TaB frame. Blank scan lines



at the vertical center of the frame *should* be double the number of the blank lines at either the top or bottom of image as shown in Figure 11 below:

Figure 11 - TaB formatting with preferred letterboxing

Any S3D content formatted as TaB where the source material is letter-boxed, ***shall not*** be misaligned such that corresponding elements of the left-eye image and the

right-eye image are not on the corresponding scan lines. For example, when the letterboxed images are connected by adjacent scan lines as shown in Figure 12 below:

Figure 12 - TaB formatting with incorrect letterbox alignment

Any S3D content formatted as SbS where the source material is side-paneled (pillarboxed) *should* be formatted with exactly the same number of blank samples on the left side of the picture as the right side of the picture as shown in Figure 13 below. See [SCTE 187-3] for additional processing considerations that can affect the image placement.

Any S3D content formatted as SbS where the source material is side-paneled (pillarboxed) ***shall*** be formatted such that corresponding picture elements of the left-eye image are always separated by exactly 960 pixels (columns) from corresponding picture elements of the right-eye image, when placed at the screen plane or zero parallax setting (ZPS). For example, elements of column 20 are aligned with corresponding elements of column 980 and so on across the image so that elements of column 939 are also aligned with elements in column 1899. Differences in this horizontal alignment will occur naturally on portions of the picture not at ZPS.

Figure 13 SbS formatting with preferred Side-Panels

9.0 MPEG-2 VIDEO SPECIFIC SIGNALING

9.1 User Data Settings for FC-S3D with MPEG-2 Encoding

Listed below are the details on user data settings for signaling 3DTV MPEG-2 content. User data settings have already been applied to carry information like Closed-Captions and AFD/Bar user_data. The primary message that is transmitted in a 3D MPEG-2 video service is the **S3D_video_format_signaling()** data. This data structure shall follow captions and AFD/Bar data if present.

The frame packing arrangement signaling information ***shall*** be inserted in the picture layer user data of Rec. ITU-T H.262 | ISO/IEC 13818-2 video bitstreams. The signaling supports switching between 2D and S3D video at frame boundaries, as well as between different frame packing arrangements for S3D video at frame boundaries. Switching between full-resolution 2D and S3D video, and between different frame-packing arrangements for S3D video, ***shall*** meet the following:

- The last access unit in video sequence before the switch ***shall*** include the **sequence_end_code** indicating an end to the current video sequence.
- Video sequence after the switch ***shall*** start with an I picture and closed GOP (see also [IEC 13818-2]).

9.2 For compatibility with existing video decoders, the method uses an indicator to be provided in **extensions_and_user_data(2)**, which follows the **picture_header()** and **picture_coding_extension()**.

When switching from 3D to full-resolution 2D, or 2D to 3D, the picture in which the signaling information changes should be temporally aligned with the change of the content.

For the entire duration of a program containing 3D video content, the video stream shall contain user data with **S3D_video_format_signaling()** for every picture.

9.3 Table 1 specifies the syntax and semantics that shall indicate a frame packing arrangement in the **user_data() of extensions_and_user_data(2)**.

Table 1 – FC-S3D Video Format Signaling in User Data

Syntax	No. of bits	Mnemonic
user_data() {		
user_data_start_code	32	bslbf
S3D_video_format_signaling_identifier	32	bslbf
while(nextbits() != '0000 0000 0000 0000 0000 0001') {		
S3D_video_format_signaling()	8	uimsbf
}		
next_start_code()		
}		

9.4 **user_data_start_code** - ***shall*** be set to the bit string 0x000001B2.

9.5 **S3D_video_format_signaling_identifier** - ***shall*** be set to the bit string 0x4A503344 ("JP3D" in ASCII).

Note: This S3D format signaling identifier is a 4-byte code value that has been selected to avoid conflict with other applications of user_data mechanism.

Table 2 - S3D_video_format_signaling() syntax

Syntax	No. of bits	Mnemonic
S3D_video_format_signaling() {		
S3D_video_format_length	8	uimsbf
reserved_bit	1	uimsbf
S3D_video_format_type	7	bslbf
reserved_data	16	bslbf
}		

S3D_video_format_length - ***shall*** be set to the bit string 0x03.

reserved_bit - This bit ***shall*** be set to the value '1'. Decoders are recommended to ignore this value.

S3D_video_format_type - See Table 3.

Table 3 - Semantics of S3D_video_format_type

S3D_video_format_type	Meaning
0000011	S3D side by side
0000100	S3D top and bottom
0001000	2D video
Other value	Reserved

reserved_data – For compliance with international standards [tbd] this 16-bit integer shall be set to the bit string 0x04FF[1] when the value of the field **S3D_video_format_type** is ‘0000011’ or ‘0000100’ or ‘0001000’. Decoders are recommended to ignore this value.

In the case of the "S3D side by side" arrangement, the picture is divided into two halves that each have half resolution horizontally. The left view is on the left side, and the right view is on the right side. The border position between the two halves is at the center of the active sampling pixels on a scan line. The indicated sampling position is the same across all scan lines. The sampling positions for the "S3D side by side" arrangement are shown in Figure 7.

> Note: The pixels marked as "-" in Figure 7 correspond to the last eight lines of a 1088 line coded picture and are outside the display area. These pixels are discarded after decoding of picture and are not displayed.

In case of "S3D top and bottom", one picture is divided by two halves sub-sampled vertically. The left view is in the upper part of the picture, and the right view is in the lower part of the picture. The border position between the two halves is at the center of the effective lines. The indicated sampling position is the same across all scan lines. The sampling positions for the "S3D top and bottom" arrangement are shown in Figure 3.

> Note: The pixels marked as "-" in Figure 3 correspond to the last eight lines of a 1088 line coded picture and are outside the display area. These pixels are discarded after decoding of picture and are not displayed.

[1] This fixed value 0x04ff resulted from accommodation for an initial deployment in Japan of 3D receivers.

10.0 AVC/H.264 AND HEVC/H.265 VIDEO-SPECIFIC SIGNALING

Listed below are the details on SEI Metadata for signaling 3DTV MPEG-4 AVC content. SEI messages have been defined in [ITU H.264] [ITU H.265] for transmission of supplemental information (such as picture timing SEI that carries film mode information and user data registered by ITU-T SEI for carriage of registered metadata). [SCTE 128-1] has used the **user_data** SEI messages in [ITU H.264] [ITU H.265] to carry information like Closed-Captions and AFD/Bar data. The message that is transmitted in a 3D video service is the frame packing arrangement SEI message.

10.1 The **frame_packing_arrangement()** SEI message with payload type 0x2D (decimal 45) ***shall*** be used to indicate the type of frame packing arrangement of the frames with the syntax and semantics as specified in AVC H.264 or HEVC H.265 and as constrained below.

10.2 The frame packing arrangement SEI ***shall*** be present in every access unit of the coded video sequence.

- The content of the SEI syntax elements (specified above) *should not* change over the video sequence or event.

- If other SEI payload types are present in any access unit (such as **pic_timing** or **user_data_registered_itu_t_t35**), the frame packing arrangement SEI (payload type = 45) ***shall*** be included in a separate NAL unit (nal unit type = 6) instead of being concatenated with other SEI payload types in the same NAL unit (note that this is allowed by AVC/H.264 and HEVC/H.265 specifications).

10.3 FC-S3D programs with SEI messages ***shall*** fully match the bold values below for interoperability with set-tops to trigger the corresponding graphics "panelization" and to facilitate the construction of HDMI 3DTV signaling:

- **frame_packing_arrangement_id: 0** (Golomb code of '1', which is 1 bit)

- f**rame_packing_arrangement_cancel_flag: 0** (informs STB that new SEI message follows)

  Note: Since the content of the SEI syntax elements is not supposed to be changed over the video sequence or event, **1** is not used.

- **frame_packing_arrangement_type: 0000011** (=Side-by-side) –OR- **0000100** (=Top/bottom)

- **quincunx_sampling_flag: 0** (default is that the luma/chroma planes in each L/R frame is not quincunx sampled)

- **content_interpretation_type: 000001** (frame 0: L, frame 1: R)

- **spatial_flipped_flag: 0** (no flipping of either frame)

- **frame0_flipped_flag: 0** (***shall*** be zero if spatial_flipped_flag=0)
- **field_views_flag: 0** (***shall*** be zero for top/bottom and side-by-side)
- **current_frame_is_frame0_flag: 0** (***shall*** be zero for top/bottom and side-by-side)
- **frame0_self_contained_flag: 0**
- **frame1_self_contained_flag: 0**

	Side-by-side (option 1)	**Side-by-side (option 2)**	**Top/Bottom (option 1)**	**Top/Bottom (option 2)**
• **frame0_grid_position_x**:	**0000** (0 decimal)	**0100** (4 decimal)	**0000** (0 decimal)	**1000** (8 decimal)
• **frame0_grid_position_y**:	**0000** (0 decimal)	**1000** (8 decimal)	**0000** (0 decimal)	**0100** (4 decimal)
• **frame1_grid_position_x**:	**0000** (0 decimal)	**0100** (4 decimal)	**0000** (0 decimal)	**1000** (8 decimal)
• **frame1_grid_position_y**:	**0000** (0 decimal)	**1000** (8 decimal)	**0000** (0 decimal)	**0100** (4 decimal)

Note: While two signaling methods are defined (option 1 and option 2) for either SbS or TaB, it should be clear that both methods describe the same alignment structure. Therefore, either signaling option can be used in the SEI message, without preference, since the actual video **frame_grid_position** alignment for both options is to be interpreted to mean the same thing: Symmetrical subsampling is used without any specific row or column alignment structure as defined above in Sections 8.2 for TaB and 8.3 for SbS formatting. No other values are permitted.

- **frame_packing_arrangement_reserved_byte: 00000000** (required by standard)
- **frame_packing_arrangement_repetition_period: 0** (Golomb code of '1', which is 1 bit)
- **frame_packing_arrangement_extension_flag: 0** (required by standard)

10.4 S3D programs formatted as SbS (**frame_packing_arrangement_type** = **3**) ***shall*** be arranged for display upconversion as described above in Figure 6.

10.5 S3D programs formatted as SbS ***shall*** also set the following VUI syntax elements as follows:

- **aspect_ratio_info_present_flag** = 1; aspect_ratio_idc =1 (8 bits); **sar_width** = 1 (16 bits); **sar_height** = 1 (16 bits) for SAR of **1:1**

10.6 S3D programs formatted as TaB (**frame_packing_arrangement_type** = **4**) ***shall*** be arranged for display upconversion as described above in Figure 2.

10.7 S3D programs formatted as TaB ***shall*** also set the following VUI syntax elements as follows:

- **aspect_ratio_info_present_flag** = 1; aspect_ratio_idc =1 (8 bits); **sar_width** = 1 (16 bits); **sar_height** = 1 (16 bits) for SAR of **1:1**

 © 2024 SCTE